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Technology Use Among Ghanaian Junior High School Mathematics Teachers in the Ahafo – Ano South District

Samuel Ahenkora[1], Emmanuel Boakye Adubofour[2], Emmanuel Gyimah Osei[3], Aminatu Ibrahim[4]

[1]Department of Mathematics Education, Catholic University of Ghana, Fiapre

[2]Mankranso Senior High School, Mankranso, Ghana

[3]Sacred Heart Anglican Basic School, Amasaman, Ghana

[4]John Evans Atta Mills Senior High School, Otuam – Ekumfi, Ghana

Correspondence: Samuel Ahenkora, Department of Mathematics Education, Catholic University of Ghana, Fiapre. Email: sahenkus@gmail.com.

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Abstract

The study sought to investigate technology use among Ghanaian Junior High School mathematics teachers in the Ahafo-Ano South District of Ghana. Descriptive survey (cross-sectional survey) design with mixed quantitative and qualitative data was gathered for the study. The population of the study comprised of all JHS mathematics teachers in Ahafo-Ano South District, Ashanti region. A stratified sampling technique was used to select 60 JHS mathematics teachers from rural, peri-urban and urban schools in the district. The findings revealed that mathematics teachers technology use in teaching Mathematics at the Junior High School level in the district was low (2.048 ± .85388). These technologies were grouped into manipulatives, digital/computer-based and audio-visual technologies. The results established that most of the teachers used manipulates in teaching Mathematics (3.120 ± 1.063). On the contrary, the results also showed that digital/computer-based technologies such as virtual protractors, calculators, geometry pad, stepping stones 2.0 comprehensive mathematics and computer game programs such as Globaloria etc., were never used by mathematics teachers in the district (1.621 ± .840). Similarly, evidence from the study adds that audio-visual technologies including television, pie chart assignment to students based on TV program and other audio-visual devices were never in use by mathematics teachers in the district (1.416 ± .712).

Keywords: technology use, junior high school, mathematics teachers, Ahafo-Ano South District, manipulative, audio-visual

1. Introduction

The rapid growth in technology has brought remarkable changes in the 21st century Africa as it affects the demands of modern societies. The call to integrate technology in education has become a major concern to Education stakeholders and policymakers in many countries all over the world (Agyemang & Mereku, 2015). Until recently, the primary teaching resources available to Ghanaian teachers were the books in libraries. The National Council of Teachers of Mathematics (NCTM, 2000) listed six principles to assist and guide teachers in improving the content and delivery of mathematics instruction namely; equity, curriculum, teaching, learning, assessment and technology. The use of technology in mathematics education allows students the opportunity to focus less on the computational aspects and to focus more on the applications of mathematics.

Several studies have highlighted teachers' use of technology in Mathematics instruction and the factors that influence their use. Keong, Horani and Daniel (2005), claim that the level of technology used by Mathematics teachers in their instruction is low. Besides, Lau and Sim (2008) revealed mathematics and science teachers in Malaysia less frequently use technology for communication with peers (26%), for personal development (12%). But frequently use internet for browsing (53%). Their findings further revealed that teachers' computer competency is possibly related to their frequent use of word processing (71%), presentation tools (50%) and courseware (63%) in preparing teaching materials and presenting lessons. Similar study conducted by Yildirim (2007) reveals that teachers largely use technology for creating handouts and tests, rather than using it to promote students critical thinking skills and to foster their higher order cognitive abilities.

Mereku, Yidana, Hodzi, Tete-Mensah and Williams (2009) also assert that technology is used in typing examination questions in all institutions and in some cases, educators use technology in processing students' examination results but very few teachers use technology in their teaching in Ghana. Agyemang and Mereku (2015), mathematics teachers often use technology for general computer applications such as finding information on the internet for teaching, communicating with colleagues and students, sending emails, attaching files to email messages and preparing notes for teaching. However, the extent to which these teachers use technology in teaching Mathematics is very low in Ghana.

Ahafo-Ano South District is in the Ashanti region of Ghana. It is a farming community with some of the inhabitants engaged in trading and few taking up teaching and other white color jobs (Ghana Statistical Service, 2014). The district is known to be deprived and has consistently maintained low rating in the Ashanti region due to poor students' achievement in the Basic Education Certificate Examination (BECE) organized by the West Africa Examination Council WAEC, since 2010 (Ahafo-Ano South District Education Service, 2016). Most of the Junior High Schools there are situated in the rural with few that may be considered to be in peri-urban and urban. Therefore, the government and other Non-governmental agencies (NGO'S) have been helping the district education system through; building of computer laboratories stocked with computers, provision of laptops, building of libraries stocked with modern books, provision of teaching learning materials such as cardboards, drawing boards, mathematical set and ICT tools for teaching and learning.

Moreover, organization of seminars, workshops, and conferences for the Ahafo-Ano South District teachers on how to integrate technology in teaching and learning was a major concern to the government and the NGO's to upgrade the teachers, students, education officers to meet national educational standard in Ghana and the World as a whole. In view of this, there was introduction of the Global Education Partnership Grant (GPEG) also known as Ghana Partnership For Education Grant in 2011/2012 in the Ahafo-Ano South District to cater for sensitization on education in the communities, minor repairs of furniture, purchase of teaching and learning materials (TLMs), organizing in-service training (INSET) for teachers on modern use of technology in teaching, purchase of set of computers, etc.

According to the Ghana Partnership for Education Grant Project Implementation Manual (2013), the Global Education Partnership Grant (GPEG), is a fund set up by the Ministry of Education (MoE) and Ghana Education Service (GES) to improve planning, monitoring and delivery of basic education services in 57 deprived districts of Ghana. The $75.5 million grant among other things was to help ensuring the four core education elements of access, quality, bridging gender gap and education management are achieved. The Ministry of Education(MoE) and the Ghana Education Service (GES) were supported with US$4.58 million grant which education directorates and schools could access through the preparation of strategic plans and school performance improvement plans (SPIP) designed in tandem with annual performance work plan of the institutions to improve programme management, monitoring and evaluation. As a result of the GPEG, teachers in the junior high schools in the Ahafo-Ano South District have benefited from several in-service education and training programmes. The use of technology in mathematics teaching and learning may be an appropriate strategy to help improve student's achievement in the subject. It is the MOE's expectation that the mathematics teachers will lay the foundation for technology integration in schools. There is therefore the need to assess the mathematics teachers' use of technology in terms of applying the skills and knowledge obtained from these in-service educations and training programme.

Objectives of the Study and Research Questions

The objectives of this research were to investigate the extent to which Junior High School mathematics teachers in the Ahafo-Ano District use technology in teaching mathematics and to examine JHS mathematics teachers' views and perceptions of the influence of technology on mathematics' teaching.

To achieve these objectives, the research questions below were formulated.

1. To what extent do Junior High School Mathematics teachers in the Ahafo-Ano District use technology in teaching mathematics?
2. What are the JHS mathematics teachers' views and perceptions of the influence of technology on mathematics' teaching?

Theoretical Framework

Technology and theoretical framework are two integral parts of both the design and functioning of integration programs (Demir, 2011). Technological pedagogical content knowledge (TPCK) is a theoretical framework obtained by adding also the technology component to the concept of pedagogical content Knowledge (PCK) that Shulman (1986) has created, in order to provide technology integration in learning-teaching environments. This framework includes how teachers' understanding of educational technologies and PCK interact with one another to produce effective teaching with technology.

The TPACK framework builds on Shulman's (1986, 1987) descriptions of PCK to describe how teachers' understanding of educational technologies and PCK interact with one another to produce effective teaching with technology. Other authors have discussed similar ideas, though often using different labelling schemes. The conception of TPACK described here has developed over time and through a series of publications, with the most complete descriptions of the framework found in Mishra and Koehler (2006) and Koehler and Mishra (2008). In this model (Figure 1), there are three main components of teachers' knowledge: content, pedagogy, and technology. Equally important to the model are the interactions between and among these bodies of knowledge, represented as PCK, TCK (technological content knowledge), TPK (technological pedagogical knowledge), and TPACK.

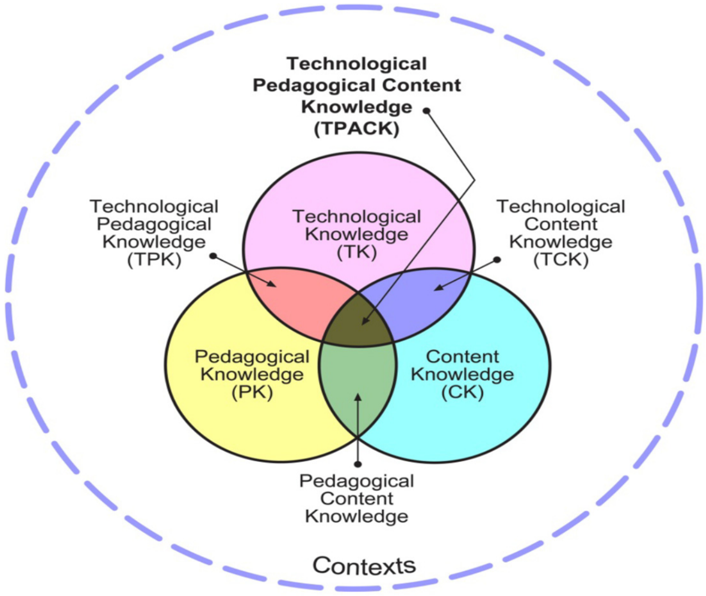

Figure 1. The TPACK framework and its knowledge components (Koehler & Mishra, 2008)

Content Knowledge (CK)

This describes teachers' own knowledge of the subject matter. CK may include knowledge of concepts, theories, evidence, and organizational frameworks within a particular subject matter; it may also include the field's best practices and established approaches to communicating this information to students. CK will also differ according to discipline and grade level – for example, middle-school science and history classes require less detail and scope than undergraduate or graduate courses, so their various instructors' CK may differ, or the CK that each class imparts to its students will differ.

Pedagogical Knowledge (PK)

This describes teachers' knowledge of the practices, processes, and methods regarding teaching and learning. As a generic form of knowledge, PK encompasses the purposes, values, and aims of education, and may apply to more specific areas including the understanding of student learning styles, classroom management skills, lesson planning, and assessments

Technology Knowledge (TK)

This describes teachers' knowledge of, and ability to use, various technologies, technological tools, and associated resources. TK concerns understanding educational technology, considering its possibilities for a specific subject area or classroom, learning to recognize when it will assist or impede learning, and continually learning and adapting to new technology offerings.

Pedagogical Content Knowledge

This describes teachers' knowledge regarding foundational areas of teaching and learning, including curricula development, student assessment, and reporting results. PCK focuses on promoting learning and on tracing the links among pedagogy and its supportive practices (curriculum, assessment, etc.), and much like CK, will also differ according to grade level and subject matter. In all cases, though, PCK seeks to improve teaching practices by creating stronger connections between the content and the pedagogy used to communicate it.

Technological Content Knowledge (TCK)

This describes teachers' understanding of how technology and content can both influence and push against each other. TCK involves understanding how the subject matter can be communicated via different edtech offerings, and considering which specific edtech tools might be best suited for specific subject matters or classrooms.

Technological Pedagogical Knowledge (TPK)

This describes teachers' understanding of how particular technologies can change both the teaching and learning experiences by introducing new pedagogical affordances and constraints. Another aspect of TPK concerns understanding how such tools can be deployed alongside pedagogy in ways that are appropriate to the discipline and the development of the lesson at hand.

Technology, Pedagogy, and Content Knowledge (TPACK)

TPACK is the end result of these various combinations and interests, drawing from them and from the three larger underlying areas of content, pedagogy, and technology in order to create an effective basis for teaching using educational technology. In order for teachers to make effective use of the TPACK framework, they should be open to certain key ideas, including:

i. concepts from the content being taught can be represented using technology,

ii. pedagogical techniques can communicate content in different ways using technology,

iii. different content concepts require different skill levels from students, and edtech can help address some of these requirements,

iv. students come into the classroom with different backgrounds – including prior educational experience and exposure to technology – and lessons utilizing edtech should account for this possibility,

v. educational technology can be used in tandem with students' existing knowledge, helping them either strengthen prior epistemologies or develop new ones.

TPACK framework considers the different types of knowledge needed and how teachers themselves could cultivate this knowledge, the TPACK framework thus becomes a productive way to consider how teachers could integrate educational technology into the classroom. Then too, TPACK can also serve as a measurement of instructor knowledge, potentially impacting both training and professional development offerings for teachers at all levels of experience. Finally, the TPACK framework is useful for the ways in which it explicates the types of knowledge most needed in order to make technology integration successful in the classroom. Teachers need not even be familiar with the entire TPACK framework as such in order to benefit from it: they simply need to understand that instructional practices are best shaped by content-driven, pedagogically-sound, and technologically-forward thinking knowledge.

2. Methodology

The study adopted descriptive design. Descriptive research deals with relation among non-manipulative variables, since the events or conditions have already occurred (Best & Kahn, 1993). In using the descriptive research design, the researcher used the quantitative means of collecting data. This design was important for the study because it helped the researcher to describe exactly the phenomenon under consideration with intense accuracy without any prejudice. Thus, descriptive research enabled the researcher to examine the situation as it was. Despite the fact that this design has some loopholes such as difficulty in getting respondents to answer questions thoughtfully and honestly and distortion of information through bias, the researcher realized that the descriptive design was most appropriate since the study did not have any experimental and control groups but reported on technology use by JHS Mathematics teachers and gave particular attention to the data to safeguard it from the influence of bias either from the researcher or the respondents.

The population for the study comprised 78 Public Junior High School Mathematics teachers in the Ahafo-Ano South District in the Ashanti Region, Republic of Ghana. The district is divided into twelve (12) circuits. Stratified sampling technique and simple random were used to select 12 circuits and 60 teachers respectively with five teachers from each of the twelve circuits by the use of proportional allocation method. Every circuit had more than five Mathematics teachers in the Ahafo Ano South District. From this number, 67.8% were male mathematics teachers and 32.2% been female mathematics teachers. The instrument used for data collection was Teachers Questionnaire. The section A of the questionnaire was responded to using a 5-point Likert scale labeled: **Not at all**, **Almost Never**, **Occasionally**, **Most of the time** and **Almost Always**. Section B asked questions on the kind of technologies used in Mathematics instruction. The section C asked questions on the impact of technology on mathematics instruction using; Strongly disagree, disagree, undecided, agree and strongly agree. These questionnaires consisted of open and close ended format.

3. Results and Discussions

To what extent do JHS Mathematics teachers use technology in teaching Mathematics? (Research Question 1)

This question presents analyses of information on the specific kinds of technologies that are used by teachers in teaching mathematics. Respondents rated the frequency to which they use various technologies in teaching, ranging from 1 = not at all, 2 = almost never, 3 = occasionally, 4 = most of the time, to 5 = almost always. The results were recoded as 1 & 2 = never, 3 = rarely, 4 & 5 = often, and used to present the summary of results on the mathematics teachers' use of basic technology in teaching.

The basic technologies used in teaching mathematics were categorized into manipulatives, digital/computer-based technology and audio-visual technology. Table 1 presents the mathematics teachers' ratings of their frequency of using manipulatives in teaching.

Table 1. Frequency and descriptive statistics of 'use of manipulatives in teaching of mathematics with technology'

	Never		Occasionally		Often			
Item	**N**	**%**	**N**	**%**	**N**	**%**	**Mean**	**Std. Dev.**
Protractor	0	0	13	21.7	47	78.3	4.2667	.79972
Graph board	40	66.7	6	10.0	14	23.3	2.4167	1.19734
Cardboards	30	50.0	11	18.3	19	31.7	2.8500	1.19071

Source: Field Data, 2023

The study determined whether mathematics teachers at the junior high school level used various basic technologies in teaching mathematics as shown in Table 1 above. The results indicate that 13(21.7%) of the respondents rarely used protractors in teaching mathematics compared to 47(78.3%) who stated that they use protractors in teaching mathematics. This means that majority of the teachers who teach at the junior high school level in the district used protractors in teaching mathematics.

With regards to the use of graph board, it was found that 40(66.7%) of the respondents affirmed that they never use graph boards in teaching mathematics compared to the remaining 6(10.0%), and 14(23.3%) who indicated that they rarely and often use graph boards in teaching mathematics respectively. This suggests that most mathematics teachers in the district do not use graph boards in teaching mathematics at the junior high school level.

Results of the study further revealed that while 30(50.0%) of the respondent stated they never use cardboards in teaching mathematics, 11(18.3%) of the respondents and 19(31.7%) of the respondents stated that they rarely use, and often use cardboards in teaching mathematics respectively. The implication of this results is that majority of the teachers in the district who teach mathematics at the junior high school level do not use cardboards.

Based on the mean scores, the results revealed that, the most used manipulatives in teaching Mathematics was protractor ($4.266 \pm .799$) whilst the least used manipulatives in teaching Mathematics was found to be graph board (2.416 ± 1.197).

Table 2: presents the mathematics teachers' ratings of their frequency of using digital/computer-based technology in teaching.

Table 2. Proportion of Mathematics Teachers' Use of Digital/Computer-based Technology in Teaching

	Never		Rarely		Often			
Item	**N**	**%**	**N**	**%**	**N**	**%**	**Mean**	**Std. Dev.**
Mobile phones	42	70.0	6	10.0	12	20.0	1.50	.81
Virtual protractor	39	65.0	6	10.0	15	25.0	1.60	.87
Stepping stones 2.0 comprehensive Mathematics	52	86.7	8	13.3	0	0	1.13	.34
Geometry Pad	51	85.0	6	10.0	3	5.0	1.20	.51
Computer game programs (eg. Globaloria, GetTheMath, etc.)	58	96.7	2	3.3	0	0	1.03	.18
Calculator	48	80.0	7	11.7	5	8.3	1.28	.61

Source: Field Data, 2023

As shown in Table 2, the uses of various digital/computer-based technologies were investigated in relation to the teaching of mathematics. Evidence from the results indicate that 42(70.0%) of the respondents affirmed that they never use mobile phones in teaching mathematics compared to few, 6(10.0%) and 12(20.0%) who stated that they use mobile phones in teaching mathematics. This result clearly suggests that the use of mobile phones in teaching mathematics at the junior high school level by teachers in the district was very low.

The use of virtual protractors by teachers was found to be very low since it was established from the results that, 39(65.0%), 6(10.0%) and 15(25.0%) of the respondents stated that they have never, rarely and often used virtual protractors in teaching mathematics. Thus, most of the teachers in the district do not use virtual protractors during mathematics instruction.

Similarly, almost all the respondents (52, 86.7%) who participated in the study indicated that they have never used stepping stones 2.0 comprehensive mathematics whilst only 8(13.3%) of them stated that they rarely use the stepping stones 2.0 comprehensive mathematics .Thus, majority of the teachers in the district affirmed that they do not use stepping stones 2.0 comprehensive mathematics in teaching mathematics.

Also, 51(85.0%) of the respondents who participated in the study stated they never used geometry pads in teaching mathematics. The remaining 6(10.0%) and 3(5.0%) of the respondents affirmed that they rarely and often use geometry pads in teaching mathematics. This means most of mathematics teachers in the district do not use geometry pads in teaching mathematics at the junior high school level.

It was noted that while only 2(3.3%) of the respondents indicated that they use computer game programs (eg. Globaloria, GetTheMath, etc.) in teaching mathematics, majority (58, 96.7%) of the respondents however indicated that they have never used Computer game programs (e.g. Globaloria, GetTheMath, etc.) in teaching mathematics. This reveals that there was no use of Computer game programs (e.g. Globaloria, GetTheMath, etc.) as a form of digital/computer-based technology in teaching mathematics by teachers in the district.

Forty-eight (80.0%) of the respondents further added that they have never used calculators in teaching mathematics compared to the remaining 7(11.7%) and 5(8.3%) of sampled respondent who indicated that they rarely and often use calculators in teaching mathematics. Thus, the results suggest that teachers who teach mathematics in junior high schools in the district do not make use of calculators in teaching mathematics.

The results shown in Table 4.3 indicated that, the most used digital/computer-based technology in teaching Mathematics in Junior High School was virtual protractor (1.600 ± .867) compared to the least used digital/computer-based technology in teaching Mathematics, which is computer game programs (1.033 ± .181).

Table 3 presents mathematics teachers' use of audio-visual technology in teaching.

Table 3. Proportion of Mathematics Teachers' Use of Audio-visual Technology in Teaching

	Never		Rarely		Often			
Item	**N**	**%**	**N**	**%**	**N**	**%**	**Mean**	**Std. Dev.**
Television	56	93.3	4	6.7	0	0	1.0667	.25155
Audio-Visual devices	52	86.7	8	13.3	0	0	1.1333	.34280
Pie chart assignment to students based on (TV) program (rainfall in Ghana)	48	80.0	7	11.7	5	8.3	1.2833	.61318

Source: Field Data, 2023

Additionally, the results as shown in Table 3 above projects the teachers' use of audio-visual technologies in teaching mathematics. It was found from the study that 56(93.3%) of the respondents indicated that they have never used television in teaching mathematics. On the other hand, 4(6.7%) of them indicated that they rarely use television in teaching mathematics. This shows clearly that mathematics teachers in the district do not use the television available in their schools and the district libraries during mathematics teaching.

Again, data from the results show that audio-visual devices are not used in teaching mathematics. This is because, 52(86.7%) of the respondents stated that they have never used audio-visual devices in teaching mathematics compared to the few, 8(13.3%) of those who affirmed to their rare use of audio-visual devices in teaching mathematics. This means that teachers in the district who teach mathematics have extremely low need for audio-visual devices in teaching mathematics.

Furthermore, it was established from the results that while 5(8.3%) and 7(11.7%) of the respondents stated that they provided pie chart assignment to students based on (TV) program (rainfall in Ghana), majority (48, 80.0%) of them indicated that they have never provide pie chart assignment to students based on (TV) program (rainfall in Ghana). The implication of such finding is that most of the mathematics teachers in the district do not provide pie chart assignment to students based on (TV) program (rainfall in Ghana).

From the results identified above, it could be concluded that teachers in the district used various basic (such as protractors) in teaching mathematics. On the contrary, digital/computer-based technologies, and audio-visual technologies were not used by teachers in teaching mathematics in the district.

Further analysis from Table 3 above, indicated that the most used audio-visual technology in teaching Mathematics was pie chart assignment to students based on (TV) program (rainfall in Ghana (1.283 ± .613) whilst the least used was television (1.066 ± .251).

The results of the overall use of technology by teachers in teaching Mathematics, as presented in Table 4. It was found that mathematics teachers technology, used in teaching Mathematics at the Junior High School level in the district was low (2.048 ± .85388).

Table 4. JHS mathematics teachers' overall use of technology in teaching of mathematics'

	N	Min	Max	Mean	Std. Dev.
Use of manipulatives	60	1.50	5.00	3.1208	1.06315
Use of digital/computer tools	60	1.00	3.86	1.6214	.84036
Use of audio-visual tools	60	1.00	3.33	1.4167	.71208
Overall use of technology in teaching of mathematics'	60	1.15	4.08	2.0487	.85388

Source: Field Data, 2023

As shown in Table 4 above, the overall use of technology in teaching of Mathematics was presented. The results established that teachers often used manipulatives in teaching Mathematics (3.120 ± 1.063). On the contrary, it was shown that the teachers, who teach Mathematics at the Junior High School level, never used digital/computer tools (1.621 ± .840) and, audio-visual tools (1.416 ± .712).

What are the JHS Mathematics teachers' views and perception of the influence of technology on Mathematics teaching? (Research question 2)

Views and perceptions for the use of various technologies in mathematics instruction by mathematics teachers are presented in Table 5

Table 5. Respondents' Views and perceptions for the Use of various Technologies in Mathematics Instruction

Reasons	Frequency	Percentage (%)
a) Makes learning simple and easier/easy understanding	39	70.9
b) Helps to improve pupils' learning/identification of pupils' learning abilities	32	58.2
c) Ensures the participation of pupils in learning process	16	29.1
d) For easy calculations (of areas of plane shapes, and complex mathematical problems)	27	49.1
e) Help students to get a pictorial representation of mathematical pupils	18	32.7
f) Ensures child-centeredness in teaching	18	32.7
g) Reduces too much talking in lesson delivery	19	34.5
h) Lack of electricity/teaching equipment	6	10.9
i) Inadequate lesson times for subject	3	5.5

Source: Field Data, 2023 *Total does not add up to 100% due to multiple responses

The views and perception for using technology in teaching mathematics were explored as shown in Table 5 above. It was found that the views and perception for the use of technology in teaching mathematics included making learning simple and easier and, enhances easy understanding (39, 70.9%), helps to improve pupils' learning and identification of pupils' learning abilities (32, 58.2%), ensures the participation of pupils in learning process (16, 29.1%), easy calculations of areas of plane shapes and complex mathematical problems (27, 49.1%), help students to get a pictorial representation of mathematical pupils (18, 32.7%), reduces too much talking in lesson delivery (19, 34.5%) and, ensures child-centeredness in teaching (18, 32.7%). It was however found that the use of some advanced technologies including digital/computer-based and audio-visual technologies were hindered due to lack of electricity and teaching equipment (6, 10.9%) and inadequate lesson times for subject (3, 5.5%).

Despite numerous views and perception established to have informed the use of various technologies in teaching mathematics, the major reason for using technology in teaching mathematics by respondents was making learning simple and easier/easy understanding. In other words, the desire to make the learning of mathematics simple and easier to understand influences teachers to use various technologies in teaching mathematics. Table 6 presents other technologies use by mathematics teachers' in teaching mathematics and their reasons.

Table 6. Other technologies Used by Respondents in Teaching Mathematics

Technology	**Reasons**
Abacus	Aid in the teaching of the concept of place value
Geoboard	Making the teaching of plane shapes such as rectangles and squares
Wall clock	Bring wall clock to the classroom for pupils to observe as it is a real material that can enhance the understanding of lesson such as bearing
Compass	For teaching construction
MS Encarta	Has been my technological tool used to learn or study on my own and I have introduced learners who have personal computers to use to learn mathematics. And it is helping those learners.
Smartphones	To search for information and some math games to teach the learners
	Have been using the internet through mathematics sites mostly www.mathefun.com. I get access to all mathematical topics at all levels of teaching.

Source: Field Data, 2023

Aside the technologies indicated in Table 4, respondents were asked to indicate any other technology used by them in teaching mathematics in school, as well as the reasons for the use of those technologies. The results indicated that the respondents used the following additional technologies in teaching mathematics, and for the purposes associated with them as shown in Table 6 above. It was found that other technologies used by respondents in teaching mathematics comprised abacus, wall clock, compass, MS Encarta, and smartphones.

4. Discussion

Technology use and its influencing factors in teaching mathematics have been identified. The study found that amongst various technologies, most mathematics teachers in the district usually used manipulatives, especially protractors in teaching their students. Other technologies including digital/computer-based technologies and audio-visual technologies were not used in teaching mathematics. Thus, these findings are unlike the results of Lynch (2017) who identified the use of numerous technologies such as geometry pad, charts, stepping stones 2.0 comprehensive mathematics amongst others, the results of the current study brought to light that digital/computer-based technologies which included stepping stones 2.0 comprehensive Mathematics, geometry Pad, charts and other geometric features, computer game programs such as Globaloria, GetTheMath, etc. and, use of calculator to perform tasks, were not employed by teachers in teaching mathematics.

Again, the study identifies audio-visual technologies were not used by teachers in teaching mathematics. This could be due to the fact that such technologies are relatively highly expensive to afford which constrained its usage in junior high schools. This result contradicted the work of Nayak et al. (2012) who established that numerous audio-visual technologies such as radio, television, audio tape and others were used in the traditional classroom. Yet, these technologies were identified as never been used by mathematics teachers. This contradicts the findings of Agyemang and Mereku (2015) who established form their study that teachers who teach mathematics in selected schools in Ashanti region of Ghana, used technology in their teaching.

The use of the above technologies was identified to be due to the need to ensure that mathematics is made simple for pupils to learn as well as easy for them to understand. These efforts to make mathematics easier to learn could be mainly as a result of the poor performance of pupils in mathematics. Thus, ensuring that it is easily understood could enhance the performance of students in terms of mathematics.

Furthermore, the use of technology in teaching mathematics was found to proffer numerous positive effects with regards to teaching and learning outcomes. The major positive effect included motivating students and as well urging them to develop positive attitudes towards teaching and learning of mathematics. The reason is that when students are able to use various required technologies and become skilled at using them, it makes the process of learning mathematics easy for them since such technologies are assistive tools that facilitates their learning. This is consistent with the results of scholars such as Driivrs (2016), Cheung and Slavin (2013), Eyyam and Yaratan (2014) and, Souter (2002) who in their studies established that when teachers used technology in teaching mathematics, students' outcomes and performance were positively affected.

The findings further revealed that, the result of the overall use of technology by teachers in teaching mathematics was low. The finding is in consonance with Agyemang and Mereku (2015) who found that the mathematics teachers' overall use of technology in teaching mathematics is low. This low use of technology in teaching mathematics at the junior high level in the district could be attributed partly to the fact that mathematics teachers in the district could lack the skills required to integrate technology in their teaching since they themselves have had little to no opportunity in participating in professional development courses concerning technology integration into teaching.

5. Conclusions

The study investigated the extent to which Ghanaian Junior High School (JHS) Mathematics teachers use technology in teaching and factors influencing its usage. The study concluded that manipulatives, specifically protractors were most used by teachers in teaching mathematics. The use of this technology is mainly due to the desire to make the learning of mathematics simpler and easier to understand.

Also, the study concluded that technology use had an effect on mathematics instruction. These effects were mainly positive on the outcome of students especially motivating students and as well urge them to develop positive attitudes towards teaching and learning of mathematics.

Recommendation

The following recommendations were proposed based on the findings of the study;

1. The Ghana Education Service (GES), the Ministry of Education (MoE) and the Government of Ghana (GoG) and NGOs should provide support to schools including financial support and, infrastructure such as computers and other visual and audio equipment.
2. Mathematics teachers should make efforts to use technologies such as computers and Televisions to enhance the visual understanding of mathematics amongst junior high school students.
3. School authorities and educational experts should help restructure the school environment.
4. Technology should be tailored to the needs of students.

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